in reality, only a net-work of cells. The frond begins with a single oblong cell terminating in from five to seven similar but smaller cells which in turn divide in like manner. In this way, a fan-like frond is formed. When moistened, the cells swell up and appear to be connected, but, on drying, the adjacent cell-walls separate leaving a net-work. In Mr. Wright's collection were specimens of the very curious *Blodgettia confervoides*, which Harvey at first supposed was a Cladophora, and which is now temporarily placed amongst the Valoniaceæ awaiting further developments. *Dictyosphœria favulosa*, found in all tropical seas, and *Valonia œgagrophila*, looking like a Cladophora which has been living too highly and become bloated, complete our list of Cuban Chlorosperms.

THE LESSER APPLE LEAF-FOLDER.

BY WM. LEBARON, M.D.

In the course of my investigations respecting the noxious insects of the State of Illinois, during the summer of 1870, my attention was attracted to a small, and so far as I can learn, undescribed species of moth, belonging to the genus Tortrix, the larva of which is extremely destructive to young nursery apple trees. It may be called the Lesser Apple Leaf-folder. (*Tortrix malivorana*, mihi. First Annual Report upon the noxious insects of Illinois, page 16. *)

Most of my observations upon this insect were made during a visit to the fruit farm of Mr. B. D. Wier, of Lacon, in the northern central part of the State, on the 22d of July, 1870. At

*Having occasion to refer to this report, I will take this opportunity to state, in reply to a suggestion of the Editors of the NATURALIST, that this report, being the writer's first annual Report as State Entomologist of Illinois, was published at Springfield, in accordance with a provision of the law of the State, under date of Dec. 15th, 1870. The whole edition, numbering five thousand copies, was destroyed by the burning, on the 23d of February, 1871, of the Public Bindery in which these reports and other State documents were deposited, for the purpose of being put in convenient form for distribution. As no action has been taken, up to the present time, by the General Assembly, upon the subject of reprinting the lost documents, it is not probable that it will be done. In this event, such parts of the report as are deemed most worthy of preservation will be incorporated in the author's next annual Report.

some distance from the place, my attention was arrested by the blasted appearance of his apple nursery, the foliage looking, at a distance, as if it had been scorched by fire. Upon entering the inclosure, the authors of the mischief were readily detected. Upon putting apart the two halves of the folded leaves, a little worm could occasionally be seen, but at this date, most of them had passed into the pupa state, and many of the moths had already emerged, so that a flock of them could be put to flight almost anywhere, by brushing against the plants. Mr. Wier says that, little known as this insect seems to be, this is not the first year that it has injured his nursery, and that other nurseries in his neighborhood have been equally infested.

This little insect furnishes a remarkable example of the sudden appearance and rapid multiplication of noxious species. The moth is so rare that I cannot learn that it has ever before been seen, even by entomologists. There is not a specimen of it in the collection of either Mr. Walsh or Mr. Riley; and Mr. Glover of Washington, who is himself an experienced lepidopterist, and is familiar with most of the eastern collections, and to whom I had an opportunity of showing my specimens, said he had never seen it, and remarked that the species is so conspicuous, notwithstanding its small size, on account of its bright orange color, that he felt confident that he would recollect it if he had ever seen it; and since then I have received a letter from Mr. Glover, in which he says that he has recently had occasion to examine several of the large collections of insects in Philadelphia and Boston, and that he could find no specimen of this moth. And yet this summer, in a single nursery of young apple trees, specimens enough could have been captured, in a short time, to supply all the cabinets in the world.

The larva of this moth is a small greenish naked caterpillar with a pale amber-brown head and pale incisions. In some individuals the whole body is of a pale brownish tint. These caterpillars occupy the upper side of the leaves, usually singly, but sometimes two or three in company, eating off the upper cuticle and curling the sides upwards till the edges nearly or quite meet, and tying them together with a web. In this inclosure the little caterpillar goes through its transformations. It lines the opposite sides of the leaf, where the pupa lies, with fine white silk.

The pupa is three-tenths of an inch long or a little less, termi-

nating anteriorly in a little knob, and posteriorly in a pair of hooks bent downwards, by means of which it works itself half way out of the closed edges of the leaf before the moth emerges. There is also a series of minute spines on the edge of some of the segments which assist in this operation.

The moth is three tenths of an inch long, the average expanse of wings being half an inch. Antennæ brown annulated with whitish on each joint, most distinctly on the under side; first joint densely clothed with orange scales. Palpi orange, horizontal; the scales project around and beyond the end of the penultimate joint so as to form a little cup in which the small ultimate joint is inserted. Tegulæ more than half the length of the thorax. Head, thorax and fore wings bright orange. The orange scales which cover the wings are observed, when seen under a lens, to be mixed with numerous whitish, almost silvery scales so arranged as to form about ten indistinct, transverse, sinuous or wavy lines. Hind wings, abdomen and legs whitish, with a silken lustre. There is a little plume of divergent scales at the end of the abdomen.

There are at least two broods of this insect in a season. The first brood of moths make their appearance early enough to deposit their eggs in the folds of the young leaves as soon as they begin to open. Another brood was just emerging, as I have above stated, in the third week of July. This brood, as Mr. Wier afterwards informed me, by letter, began at once to deposit its eggs upon those leaves which had escaped the ravages of the first brood of larvæ.

According to my own observation, the caterpillars of the earlier brood draw the edges of the leaf upwards by means of their web, till they meet, thus forming a roof over the insect which protects it from the weather, and must also in a great measure serve to conceal it from birds and other enemies. It must also form a serious barrier to the effective use of any destructive applications on our own part. But Mr. Wier informs me that the young of the last brood, hatching as they do, on the surface of the mature and rigid leaf, do not draw its edges together, but simply protect themselves by constructing a web over the surface of the leaf. In what form they pass the winter has not been determined. Mr. Wier affirms that he has seen the worms on the leaves so late in the fall that they were actually frozen to death.

From the above account it is evident that this insect resembles,

in most of its habits, the larger Tortrix (*Lozotœnia rosaceana*) of the apple and the rose.

If this insect should spread so as to infest other nurseries, as it has that of Mr. Wier, and others in that section of country, it would prove itself a pest of the most serious character; and, as far as we can judge from present appearances, it will be a difficult matter to reach them with destructive agencies, both on account of the closure of the leaf in which they dwell, and their webby covering. Fortunately, as is the case with most other double-brooded insects, the first brood is comparatively limited in numbers; and Mr. Wier thinks that it would have paid him well to have gone through his nursery, early in the season, and picked off the folded leaves.

The importance of combating evils in their incipient stages can find no more apt illustrations than in the department of economic entomology. Many noxious insects can be substantially eradicated in their infancy, which, if permitted to attain a larger growth and a wider range, are wholly beyond our control. This is emphatically the case with the present species. It is evident that whatever applications we may make use of here, must be made before the young insects have time to close the leaf above them, in the case of the first brood, and before they have covered themselves with a web, in the second. These periods will probably be found to be about the first week of May and the first week of August. But the time will vary somewhat with the character of the season, and must be determined by actual inspection. These little worms are so tender, and so unprotected by any hairy covering, that I should expect them to be easily destroyed by any of the ordinary applications, such as lime, ashes or soapsuds, provided we can find a time when the substance applied will really reach them. Mr. Wier informed me that he discovered a bug with many bright stripes, preying upon these caterpillars, which, from his description, I suppose to be the *Harpactor cinctus*, a well-known predaceous insect of the Hemipterous order. But this tribe of predaceous insects is not usually sufficiently numerous to check the increase of such a locally abundant species as the *Tortrix malivorana*.